

The diagram illustrates a catalyst injection system. At the bottom left, a **CATALYST SUPPLY** is connected to a **CATALYST FILTER**. The filtered catalyst flows into a **CATALYST INJECTION PUMP**, which is driven by an electric motor. The pump feeds catalyst into an **ACCUMULATOR**, which maintains a steady pressure. From the accumulator, the catalyst flows into a **CATALYST/FUEL MIXER**. Simultaneously, **FUEL OIL TO BURNER (TREATED)** enters the mixer from the top. The mixture then passes through a **FUEL METER** before reaching the **CATALYST ATOMIZING NOZZLE**, which sprays the catalyst-fuel mixture into the burner. A separate line for **FUEL OIL FROM BURNER (UN-TREATED)** exits the burner assembly. A **CALIBRATION TUBE** is also shown, connected to the system for measurement purposes.

Figure 1: Metered Injection Pumping System for adding resid fuels

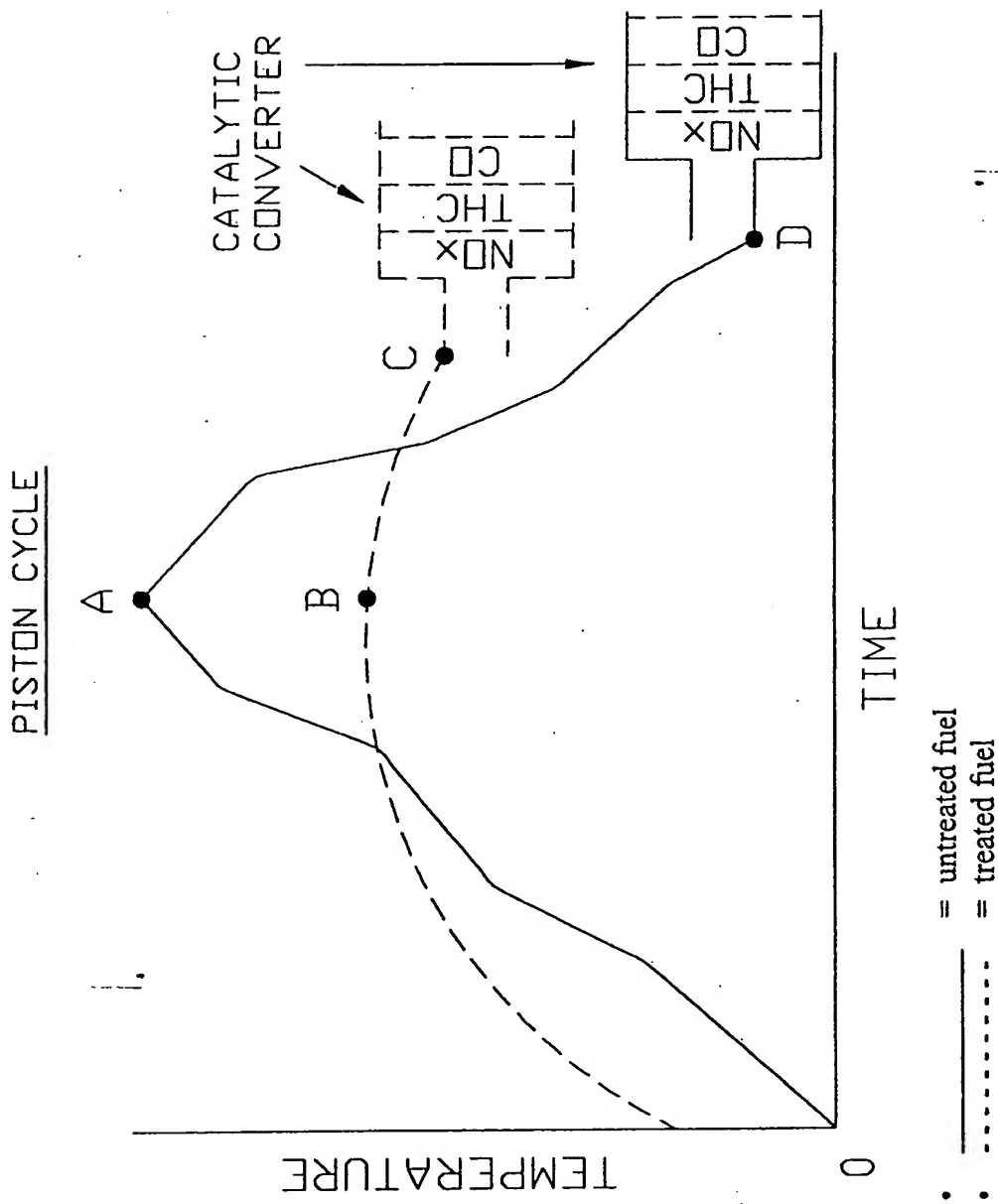


Figure 2: Hypothetical temperature versus time curve for the piston cycle of a gasoline-powered engine operating on untreated fuel and fuel treated with the OR-1 additive

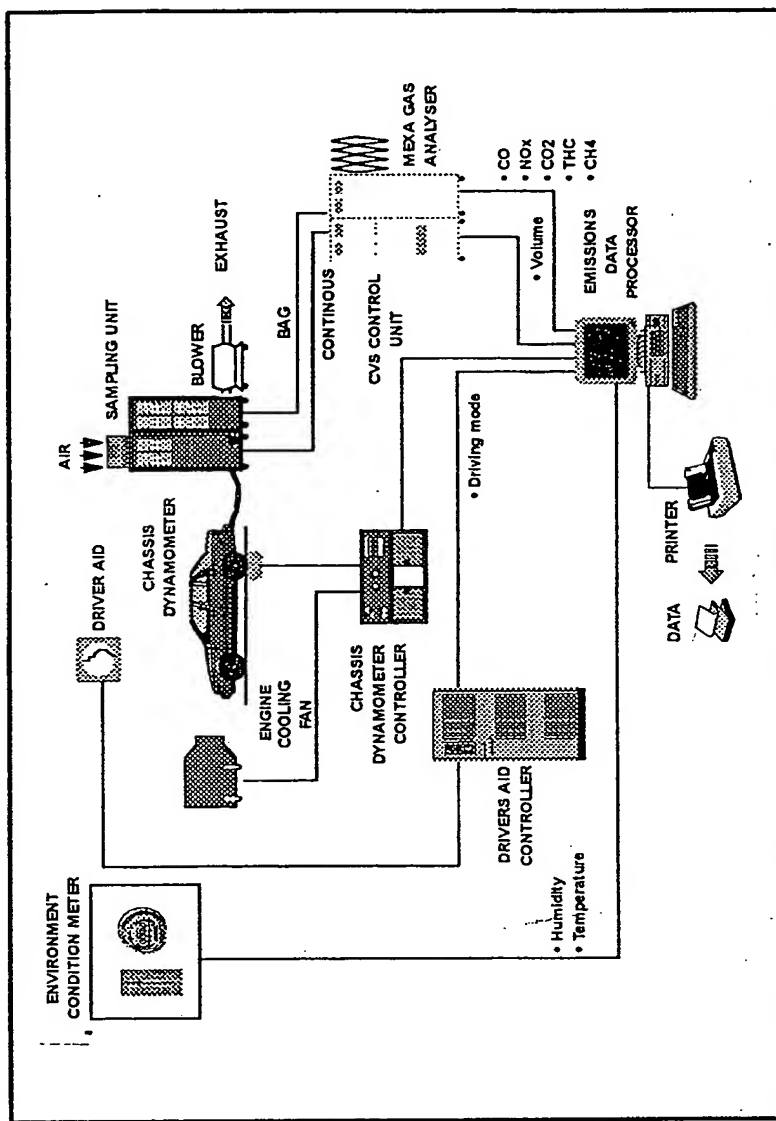


Figure 3: Schematic illustrating the layout of the Vehicle Emissions Testing Laboratory located in Section 27, Selangor Darul Ehsan, Shah Alam, Malaysia

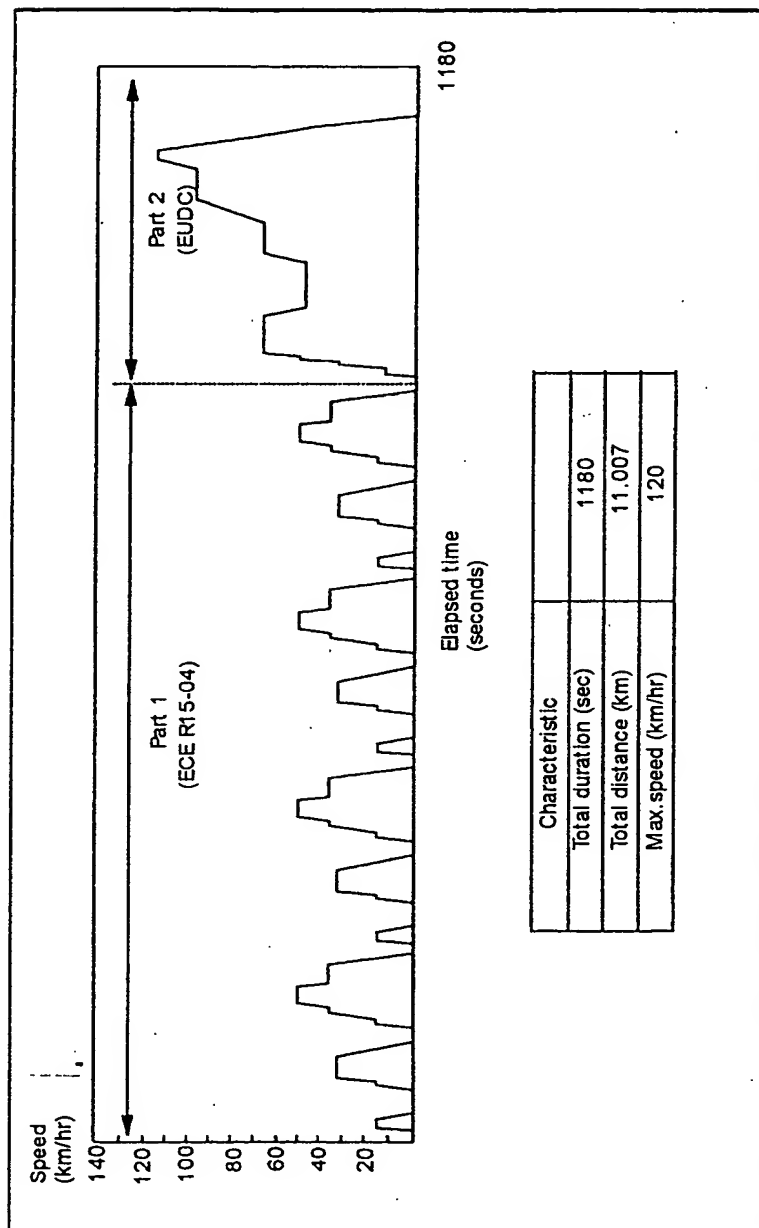


Figure 4: Diagram illustrating the European Emissions Standard ECE R15-04 plus EUDC Emissions Test Cycle

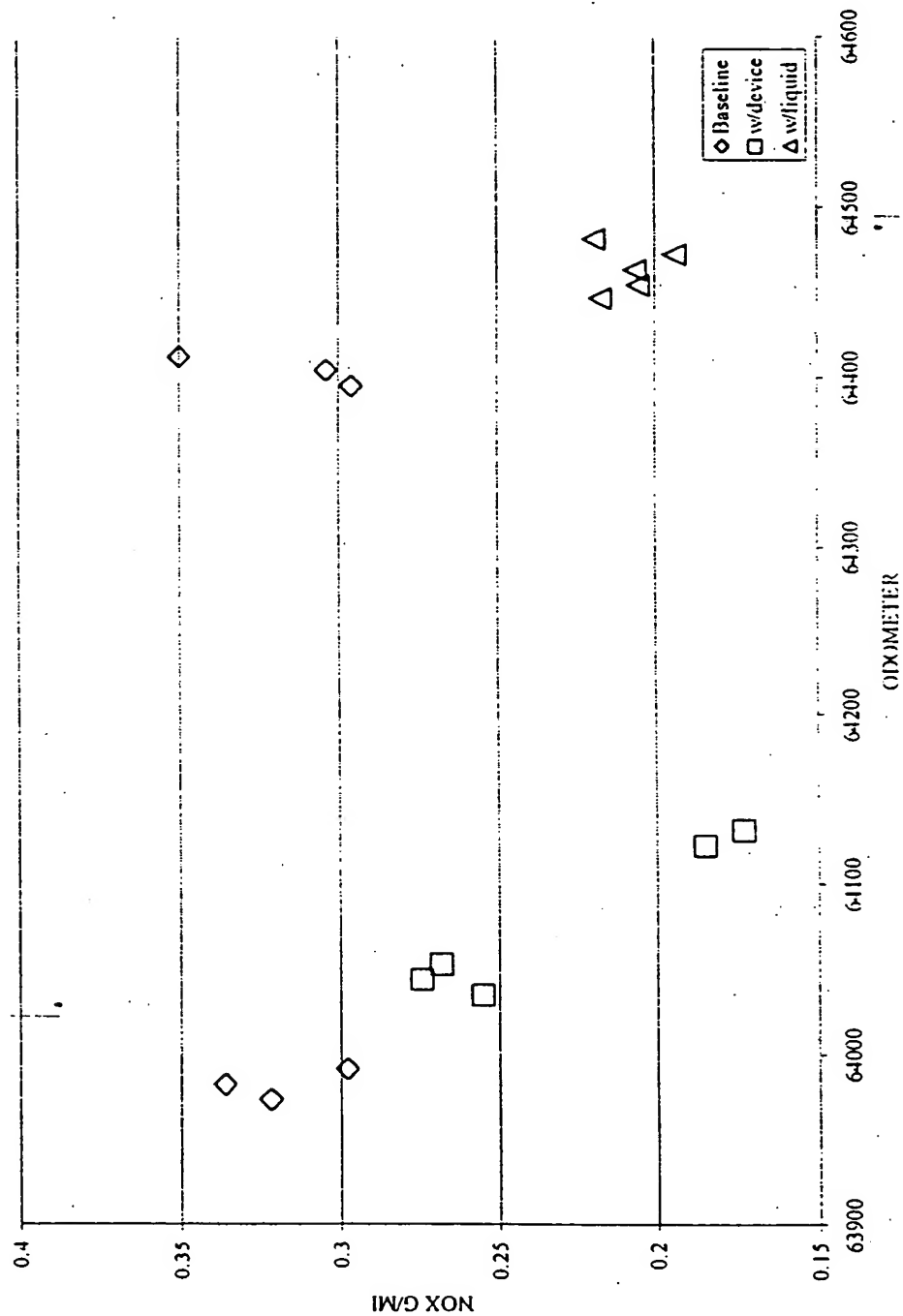


Figure 5: NO<sub>x</sub> emissions as a function of odometer miles for a Ford Taurus

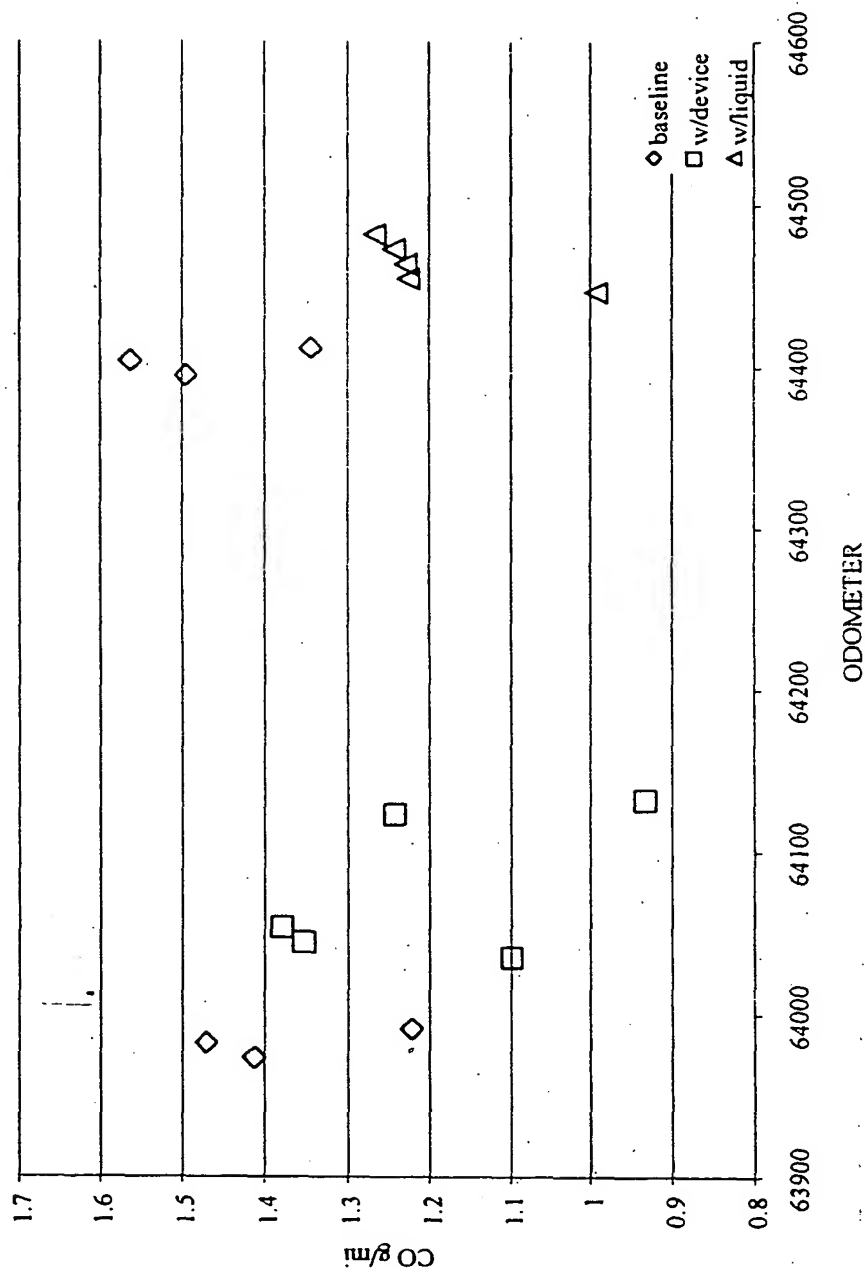


Figure 6: CO emissions as a function of odometer miles for a Ford Taurus

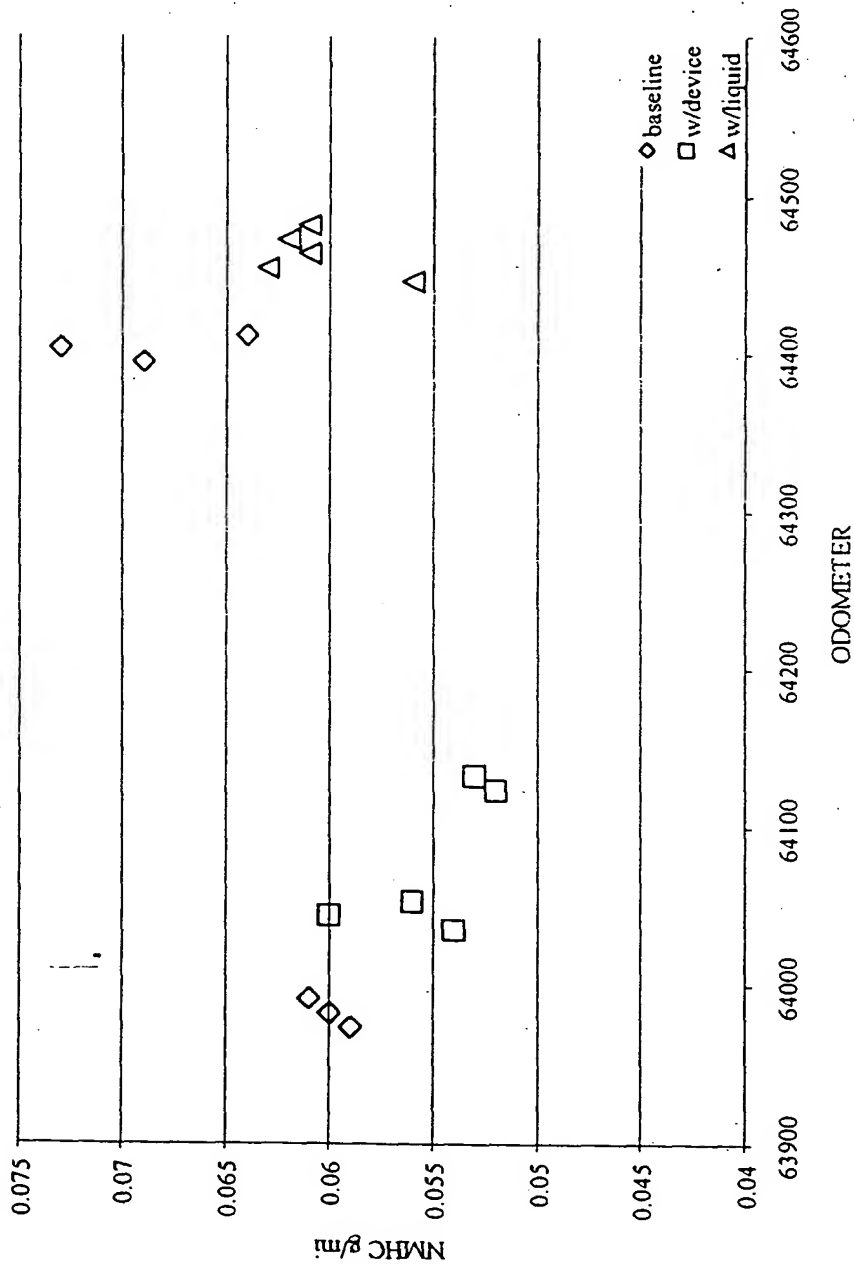


Figure 7: NMHC emissions as a function of odometer miles for a Ford Taurus

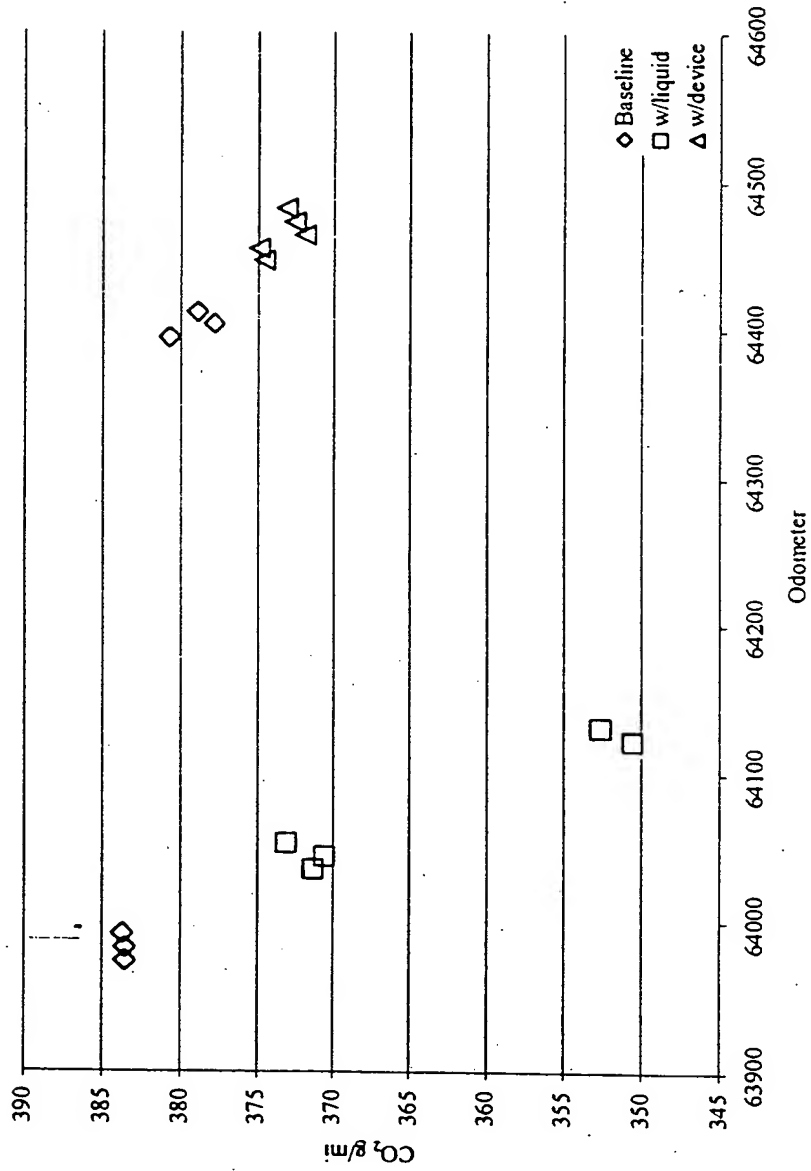


Figure 8: CO<sub>2</sub> emissions as a function of odometer miles for a Ford Taurus

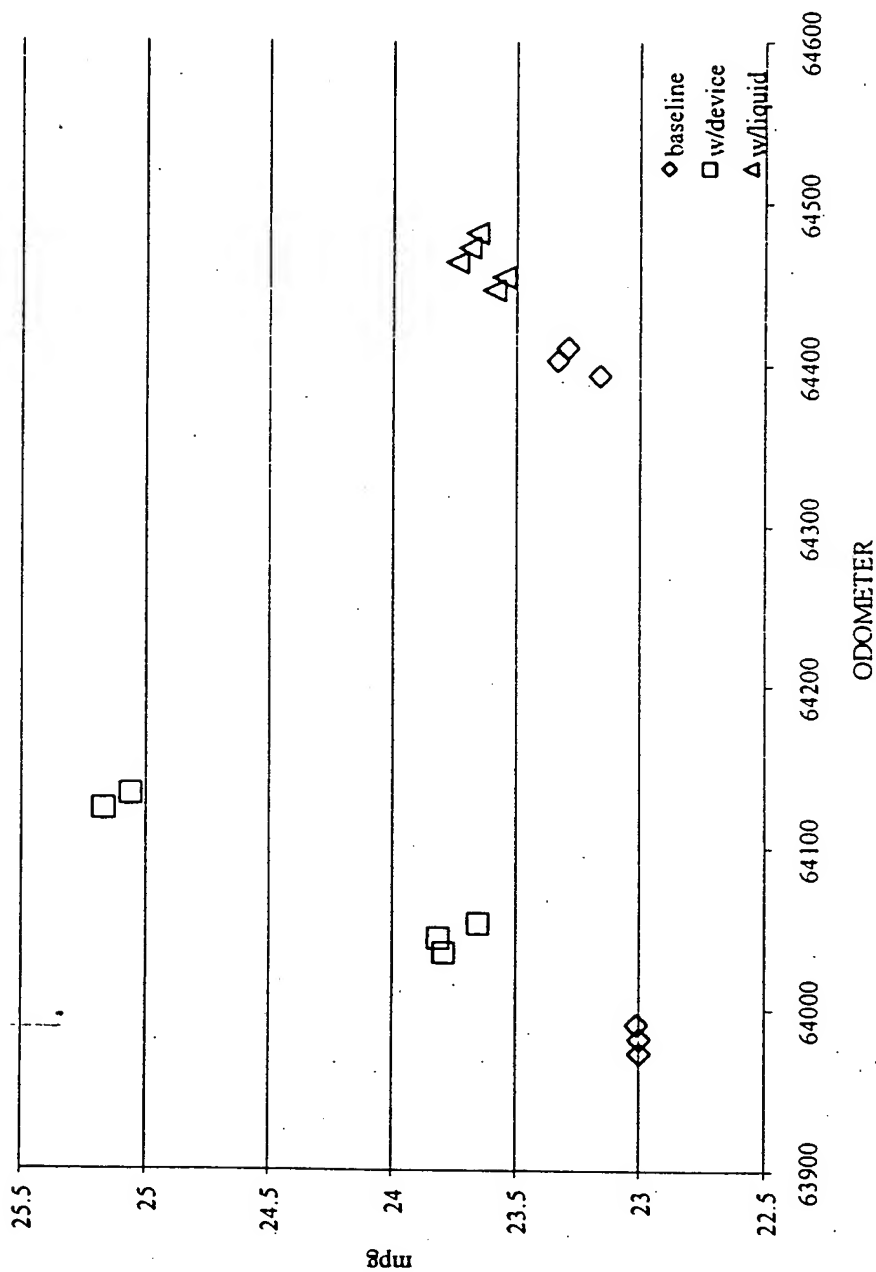


Figure 9: MPG fuel economy as a function of odometer miles for a Ford Taurus

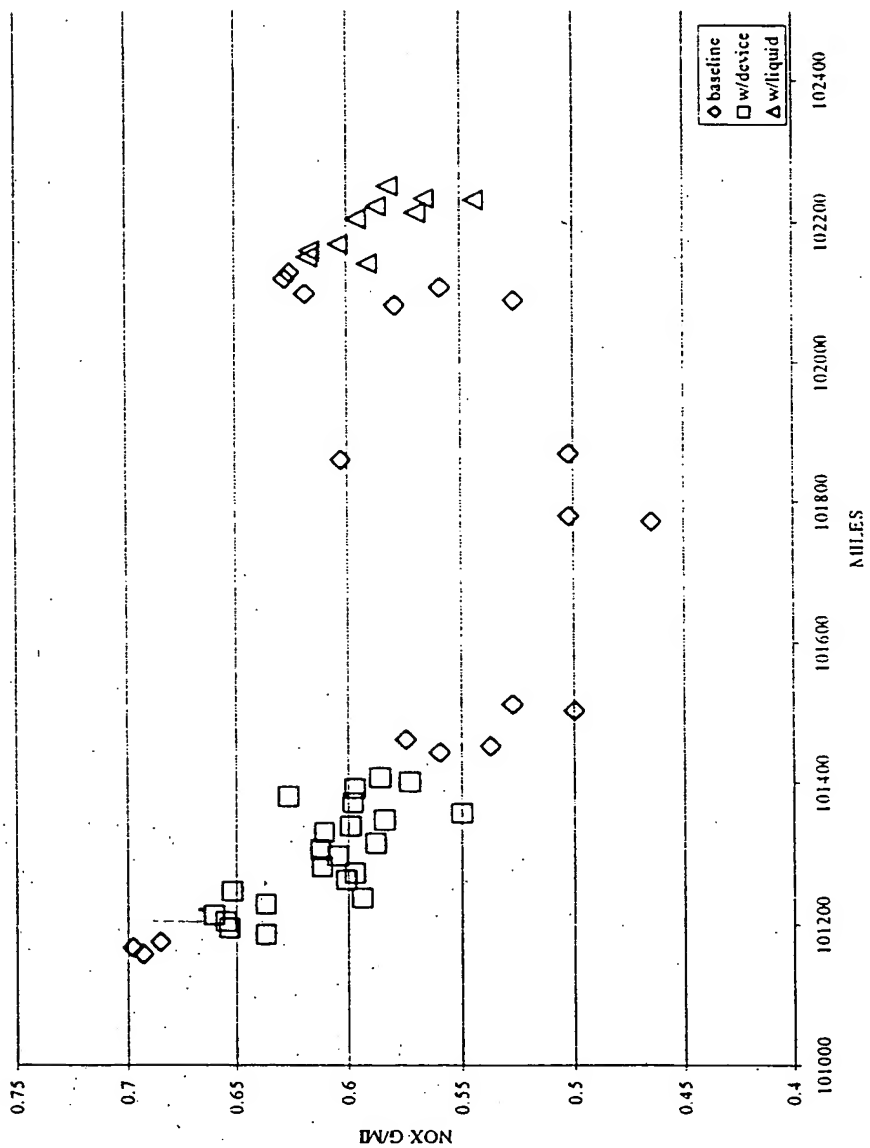


Figure 10: NO<sub>x</sub> emissions as a function of odometer miles for a Honda Accord

The scatter plot displays CO<sub>2</sub>/mi on the y-axis (ranging from 0 to 3) against ODOMETER on the x-axis (ranging from 100900 to 102500). Three data series are plotted: baseline (diamonds), w/device (squares), and Δw/liquid (triangles). The baseline series shows a general downward trend from approximately 2.5 at 101000 to 1.0 at 102500, with a notable increase around 101100-101200. The w/device series shows a similar trend but with more variability, particularly between 101100 and 101300. The Δw/liquid series is clustered between 101000 and 101200, showing values between 1.5 and 2.0.

ODOMETER	baseline (CO <sub>2</sub> /mi)	w/device (CO <sub>2</sub> /mi)	Δw/liquid (CO <sub>2</sub> /mi)
101000	2.5		
101050	1.8		
101100	1.5	1.5	
101150	1.8	1.5	
101200	2.0	1.5	
101250	1.8	1.5	
101300	1.5	1.5	
101350	1.5	1.5	
101400	1.5	1.5	
101450	1.5	1.5	
101500	1.5	1.5	
101550	1.5	1.5	
101600	1.5	1.5	
101650	1.5	1.5	
101700	1.5	1.5	
101750	1.5	1.5	
101800	1.5	1.5	
101850	1.5	1.5	
101900	1.5	1.5	
101950	1.5	1.5	
102000	1.5	1.5	
102050	1.5	1.5	
102100	1.5	1.5	
102150	1.5	1.5	
102200	1.5	1.5	
102250	1.5	1.5	
102300	1.5	1.5	
102350	1.5	1.5	
102400	1.5	1.5	
102450	1.5	1.5	
102500	1.0		

Figure 11: CO emissions as a function of odometer miles for a Honda Accord

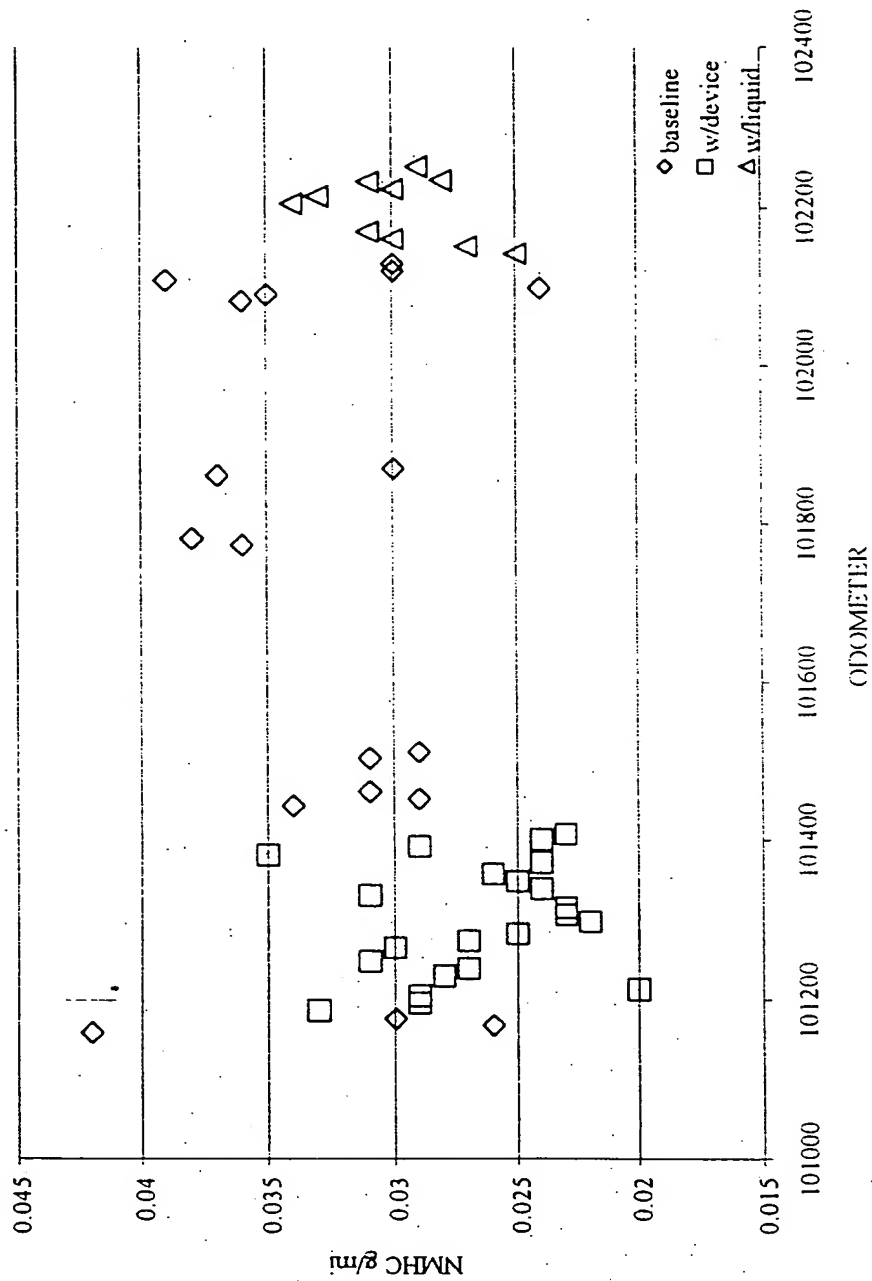


Figure 12: NMHC emissions as a function of odometer miles for a Honda Accord

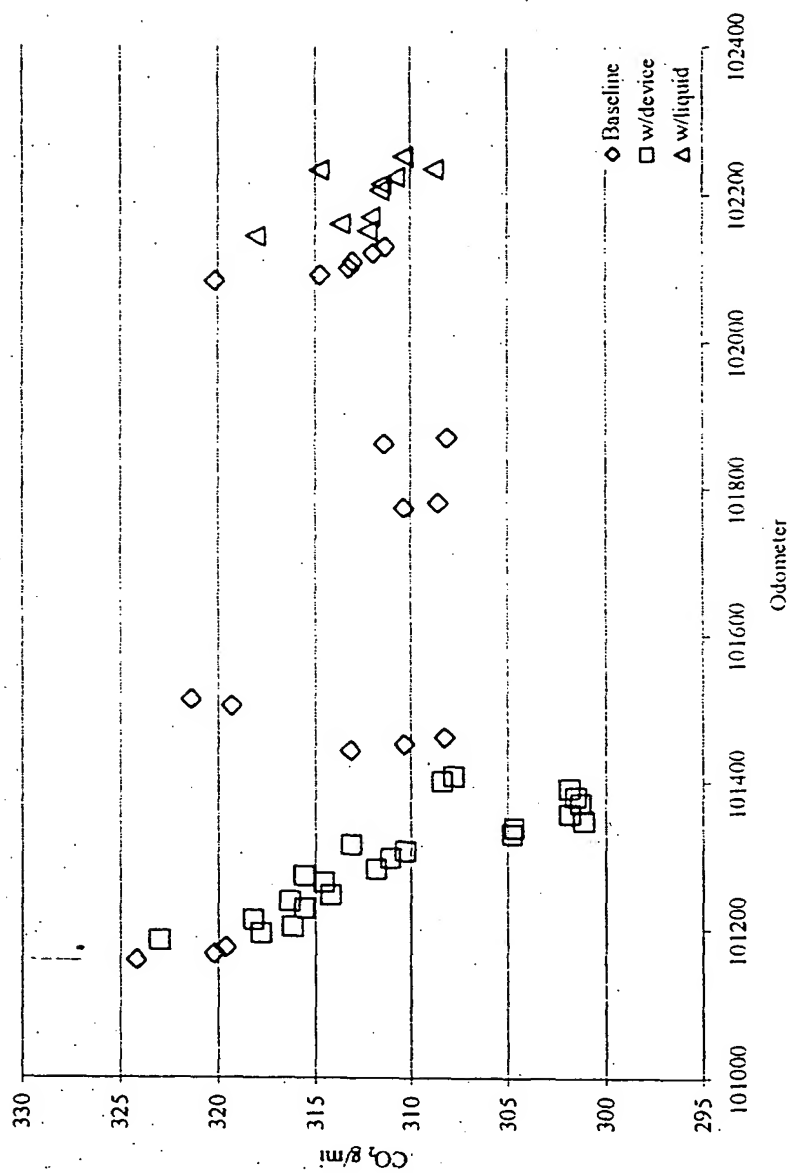


Figure 13: CO<sub>2</sub> emissions as a function of odometer miles for a Honda Accord

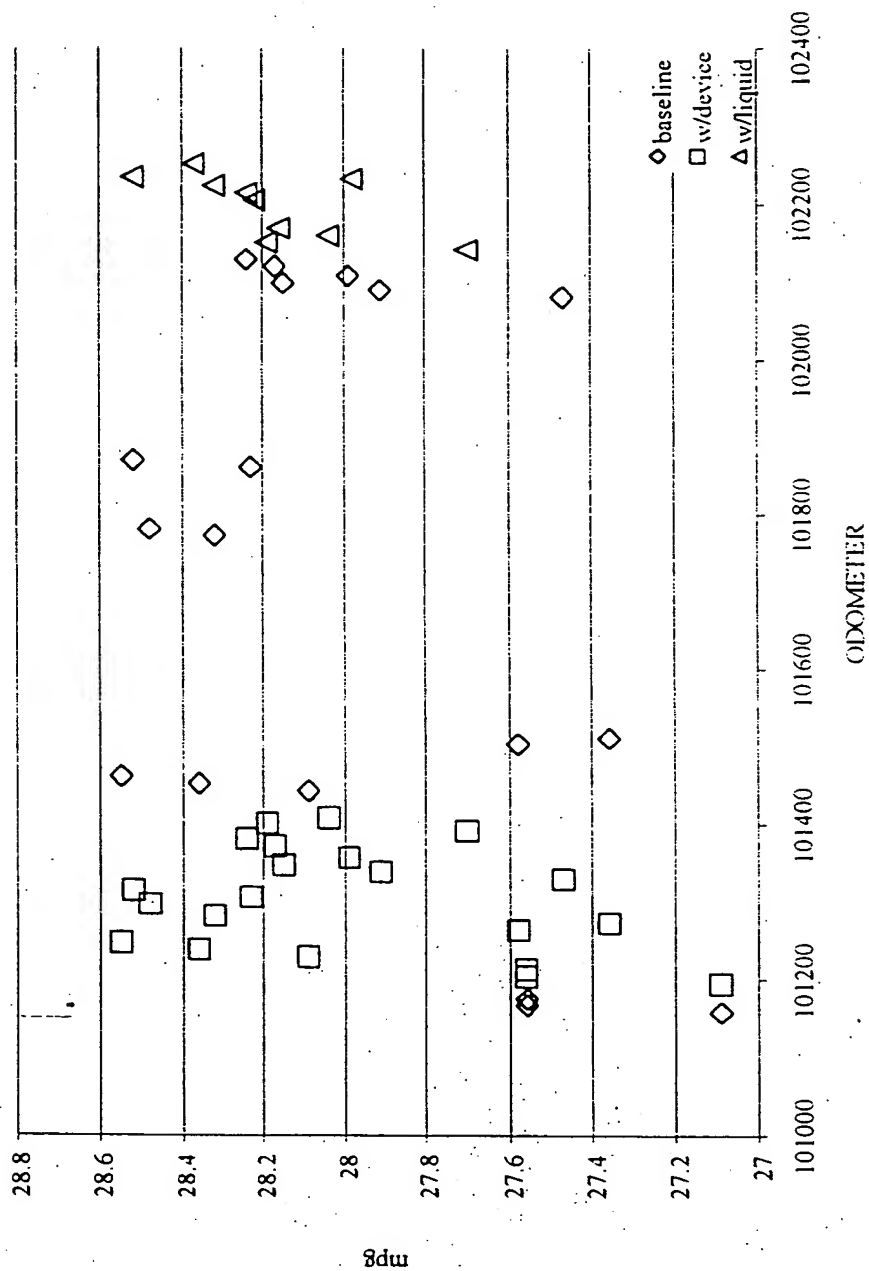


Figure 14: MPG fuel economy as a function of odometer miles for a Honda Accord

**first 3 baselines excluded**

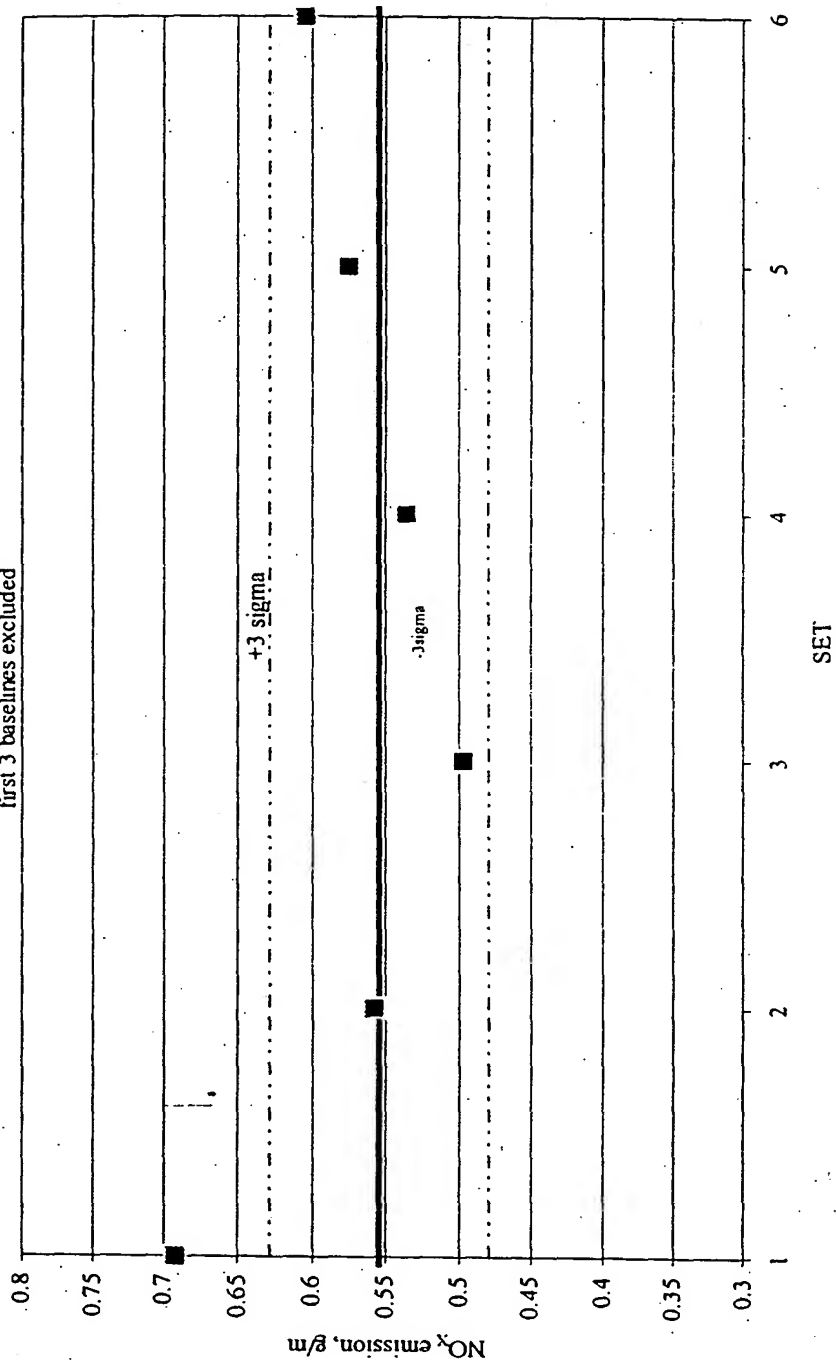


Figure 15: Shewhart Control Plot for  $\text{NO}_x$  in the Honda Accord with the first three baselines excluded

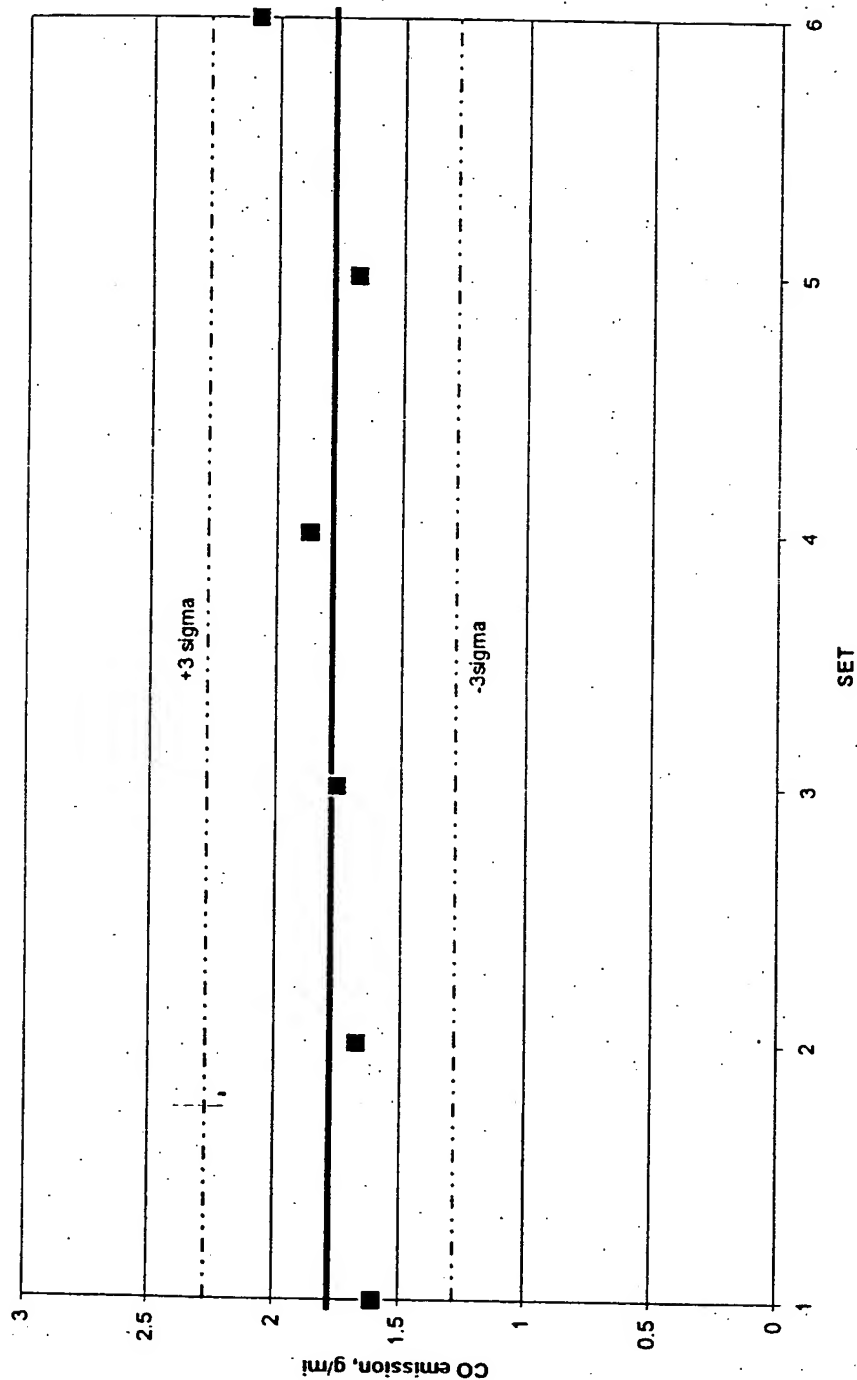


Figure 16: Shewhart Control Plot for CO in the Honda Accord with the first three baselines excluded

Scatter plot showing NMHC emission (g/m) versus SET for 10 vehicles. The y-axis ranges from 0 to 0.05 g/m. The x-axis ranges from 1 to 6. A solid horizontal line represents the mean, and dashed lines represent the  $\pm 3\sigma$  limits.

SET	NMHC emission (g/m)
1	0.033
2	0.032
3	0.034
4	0.036
5	0.034
6	0.035

Figure 17: Shewhart Control Plot for NMHC in the Honda Accord with the first three baselines excluded.

# CO2 EMISSION

## HONDA

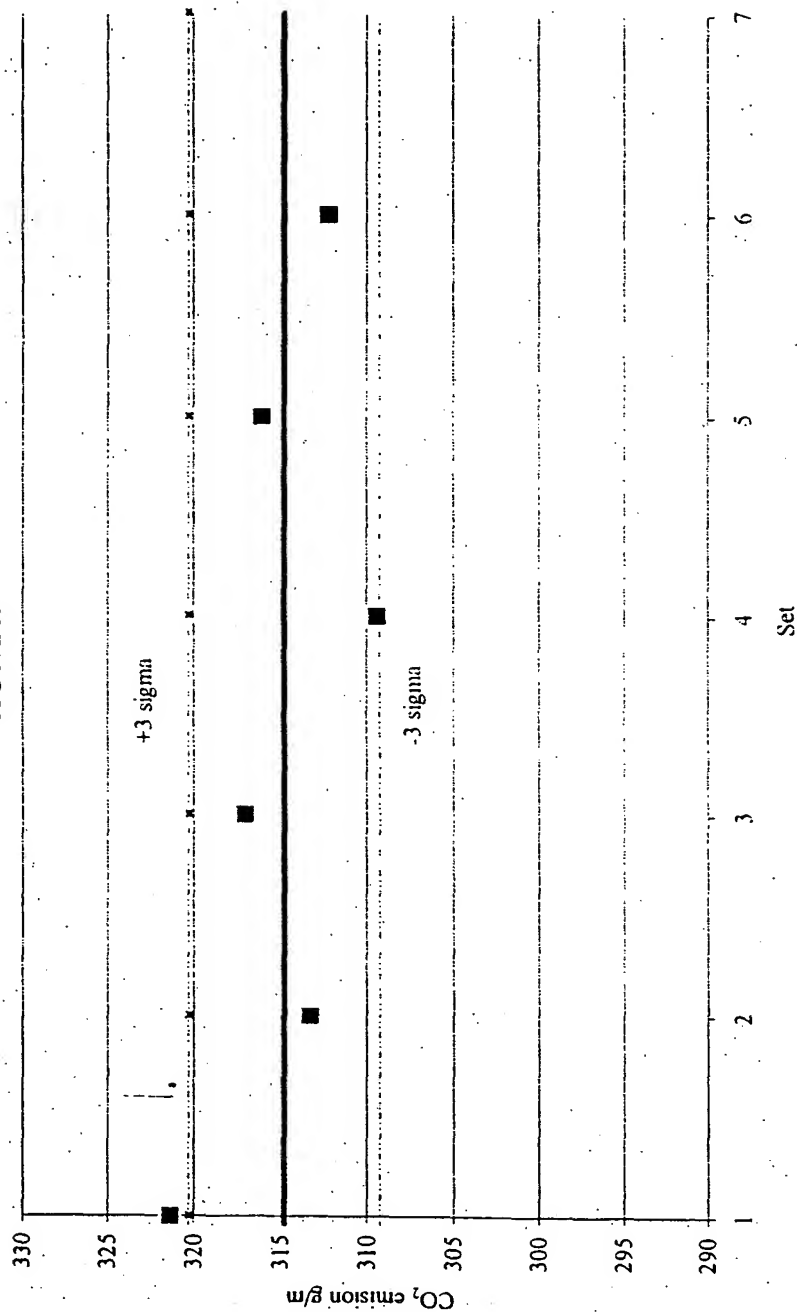


Figure 18: Shewhart Control Plot for CO<sub>2</sub> in the Honda Accord with the first three baselines excluded

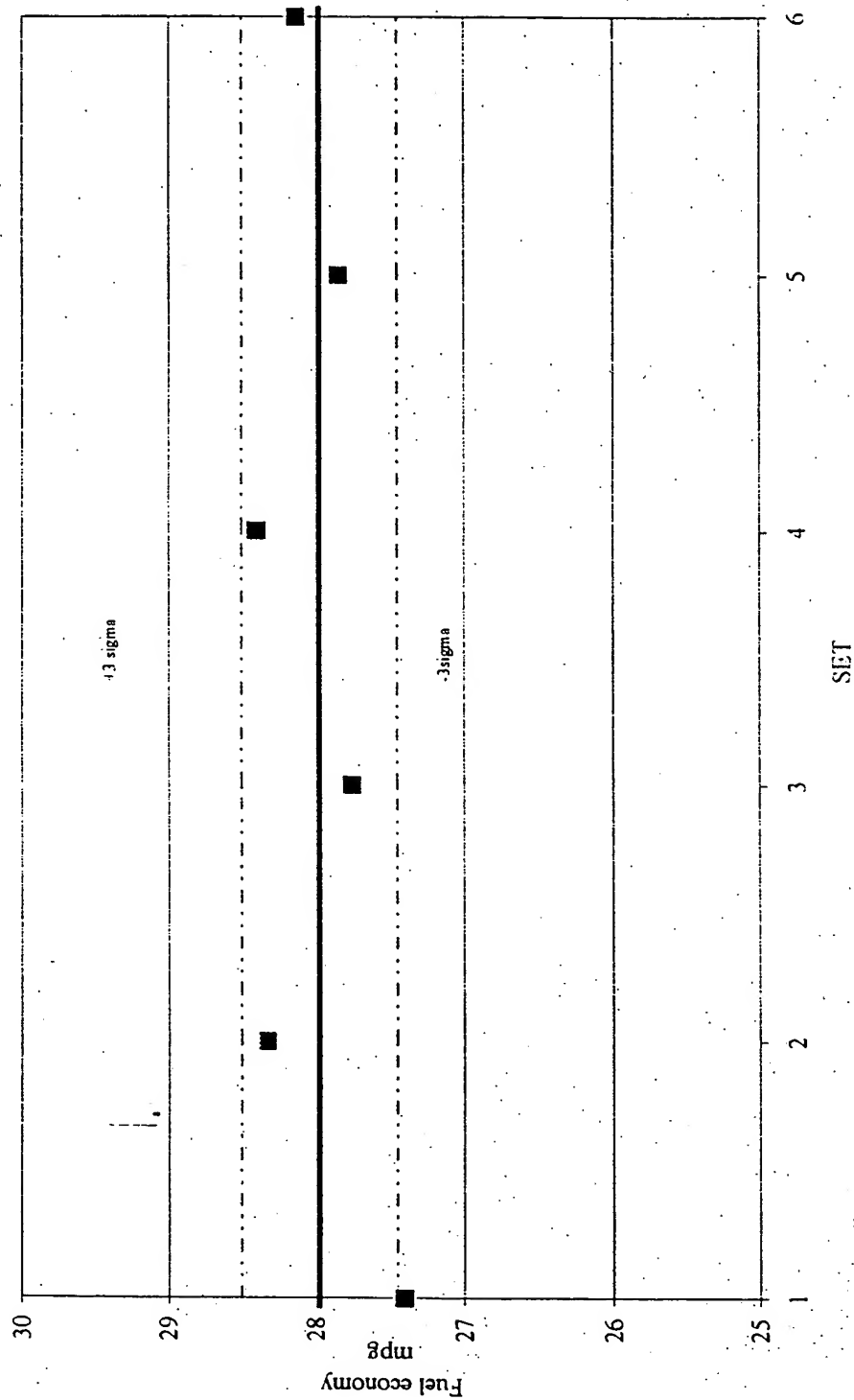
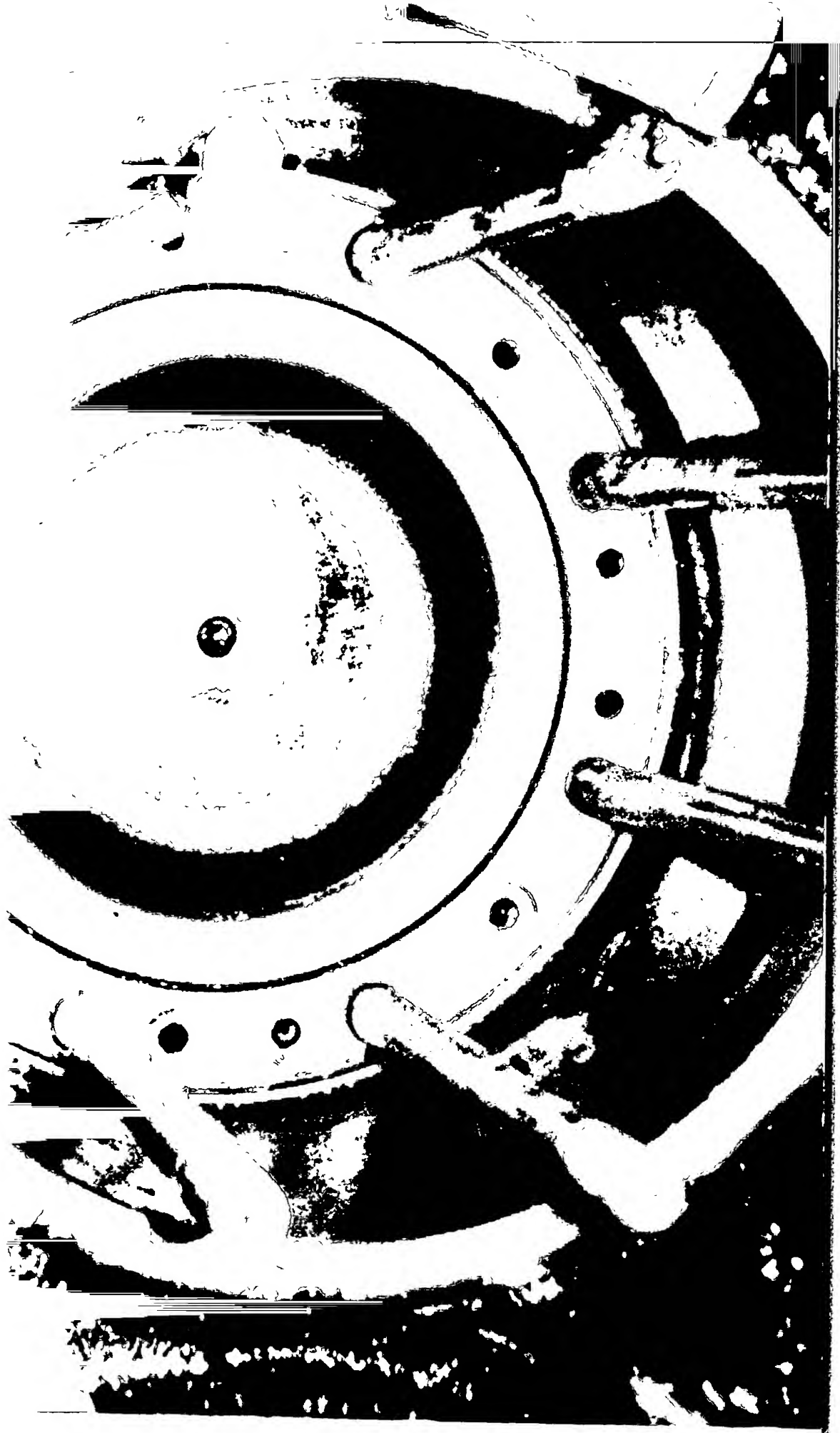
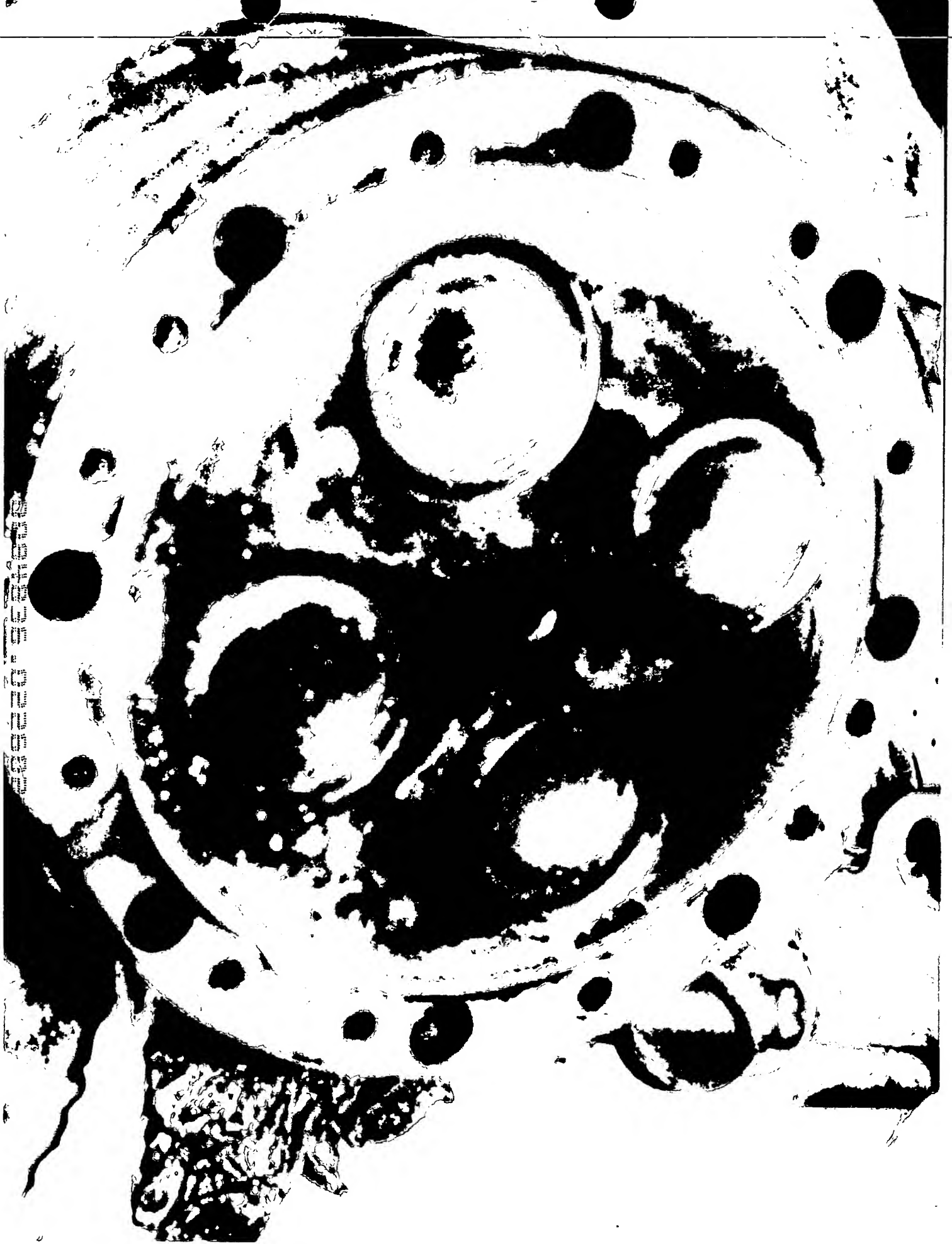


Figure 19 : Shewhart Control Plot for mpg fuel economy in the Honda Accord with the first three baselines excluded





1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081																			

